EFFECT OF DIGITAL TECHNOLOGY ON STUDENTS ACHIEVEMENT AND INTEREST IN BASIC SCIENCE AND TECHNOLOGY

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Abstract
The study was designed to find out the effect of digital technology as innovational approach in enhancing students' achievements and interest in basic science among secondary school students. Two research questions were raised to achieve the objectives of the study. A quasi-experimental design of the non-equivalent control group was used for the study.The population of the study comprised of 6211 JSS students. 121 students comprised of 59 experimental students and 62 control group students participated in the study. Data were generated through the Basic Science concept test (BSCT) and Basic Science and Technology interest scale (BSTIS). the instruments were subjected to face and content validation. The relaiablity coefficient of the BSCT was found to be 0.75 using kuder Richardson estimate while 0,85 was obtained for BSTIS using Cronbach Alpha technique. These showed that the instruments were reliable. The data obtained were analyzed using Mean and Standard deviation to answer the research questions raised while analysis of covariance (ANCOVA) was used to test the formulated hypotheses at $p<0.05$ level of significance. The findings of the study revealed that the experimental group achieved higher than the control group. Further findings also showed that the experimental group had higher interest than the control group. Based on the findings of the study some recommendations were made.

Keywords: Achievement, Basic Science, Digital Technology, Curriculum, Assessment

Introduction

The 9-year Basic Science and Technology Curriculum is the product of re-alignment and restructuring of the revised curricula for Primary Science and Junior Secondary School Integrated Science. In selecting the contents three major issues shaping the development of nations worldwide, and influencing

the world of knowledge today were identified. These are globalization, information and communication technology (ICT) and entrepreneurship education. The desire of Nigeria to be identified with contemporary development worldwide, called for the infusion of relevant contents of four non-school curriculum innovations in the areas of; Environmental Education (EE), Drug Abuse Education (DAE), Population and Family Life Education (POP/FLE) and Sexually Transmitted Infection (STI) including HIV/AIDS. Basic Science and Technology Curriculum was revised in 2012 as the result of the restructuring and integration of four Primary and Junior Secondary science curricula. The following science subjects were integrated into one: Basic science, Basic technology, Physical education and health and Information technology. This became necessary in order to reduce the number of subjects offered in Primary and Junior Secondary schools, to prevent repetition and duplication of concepts that resulted in curriculum overload, to encourage innovative teaching and learning approaches and techniques that promote creativity and critical thinking in students, to promote the holistic view of science at this level for better understanding of a contemporary and changing world, and to infuse emergent issues that are of national and global concern, such as gender sensitivity, globalisation and entrepreneurship, into the curricula. The science and technology contents were arranged in the curriculum from simple to complex under four themes namely: You and Environment, Living and Non-Living Things, You and Technology (which is Science and Development at the Upper Basic level) and You and Energy (Nigerian Educational Research and Development Council (NERDC, 2013).

The main objectives of the curriculum are to prepare the students to: develop interest in science and technology, acquire basic knowledge and skills in science and technology, apply Scientific and technological knowledge and skills to meet contemporary societal need stake advantage of the numerous career opportunities provided by science and technology become prepared for further studies in science and technology, avoid drug abuse and relative vices, be safety and security conscious (NERDC, 2013). The teachers are expected to deliver the curriculum objectives through appropriate teaching approaches and strategies. According to Aniwgwu, (2018) the basic science and technology curriculum aims to help children develop basic scientific ideas and understanding about the biological and physical aspects of the world, and the processes through which they develop this knowledge and understanding. Therefore, the workability of any curriculum depends on its effective delivery which involves the students, the teacher, teaching methods and other innovative approaches like digital technology as well as advances in the learning of science. Technology is an instrument for achieving social,

economic, educational, scientific and technological development a vital role in the students' development and the nation in general.Technology is the sum of techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation. Technology can be the knowledge of techniques, processes, and the like, or it can be embedded in machines to allow for operation without detailed knowledge of their workings. Systems (Ani, 2016). Technology provides meaningful learning experiences and numerous hands-on learning opportunities that can be integrated into all school curricular areas including Basic Science and Technology, Mathematics, Civic Education as well as other secondary school subjects. Technology also gives students opportunities to collaborate with their peers resulting in learning from each other. Technology has dramastically changed the environments and process by which students learn and communicate, teachers instruct and assessments are designed and administered. Paper-and-pencil tests are slowly becoming a thing of the past as assessments are now increasingly being designed as adaptive and delivered online (Computer adaptive testing, computer-based testing), employing dynamic and interactive tasks and simulations (Aniugwu, 2018). Technology has greatly influenced the educational sector especially on teaching, learning and research. It has a positive impact on student learning because of the advances in technologies rapidly occurring globally, technology is relevant to all the students. The waves of innovations, ushered in by technological advances in the Basic science and Technological learning has revolutionized the science of assessment, in-depth acquisition of scientific attitudes and skills.

Currently, students rely to a great extent on technology. Literature from educational research supports the claim that using ICT in teaching results in a greater degree of learning as the students seem to concentrate better and for more sustained periods of time, according to Ainsworth and Loizou (2013). Many students today as learners have been brought up in a world of technology, so without visuals in a presentation the learners may not learn (Smaldino, Lowther & Russell, 2018). Present day students are more used to absorbing information from the screen than from the printed page, and they find teachers who use technology to be more reliable and knowledgeable than those who don't (Lytras, Gasevic, Ordonez & Huang 2018). Teachers need to keep in mind that they are preparing to teach in the 21st century and that they are teaching 21st century children who have become accustomed to 21st century technology. While a teacher today is perhaps best described as a digital immigrant, the students are more appropriately described as digital natives (Niess, Lee, & Kajder 2008). Teachers remain the link between learning and the learner. The way in which they prepare their lessons and

capture the attention, motivation and concentration of the learner is of the utmost importance. Teachers are keys for assuring educational reform that adequately prepares students to meet the challenges of the twenty-first century (Niess, Kajder. 2018). Many teachers are however making use of technology in the classroom but merely as an added resource and therefore the teacher is still directing the learning especially in Basic Science. Basic Science is a subject which embraces all science subjects, namely: biology, chemistry, physics and mathematics. Adewumi, as citied in Okolo, (2017) noted that, it is a subject that cut across the school curriculum and needed in all branches of science, applied science and social sciences. This implies that for a student to be able to study single science subjects at the senior secondary school level successfully, such students had to be well grounded in Basic Science at the junior secondary level. In view of this, Basic Science is given great emphasis in the junior secondary school curriculum so as to enhance students performance.

The poor performance in Basic science according to Ani (2016) is due to the methods of teaching, attitude of the teachers that teach the subject and students lack of interest in the subject. Interest is believed to be an important variable in learning because when one is interested in an activity, one is likely to perform positively. Okolo (2017) opines that interest can be expressed through simple statements made by individual of their likes and dislikes. It can be observed through overt action or activities being performed by the subject. This implies that lack of interest may be caused by uninteresting teaching methods and inability to use ICT in teaching. Also, Ani (2016) attributed the poor performance to the low quality of Basic science teachers turned out by our tertiary institutions. Thus efforts are being made by educators to improve students' performance through the use of appropriate teaching methods and innovative approaches that will enhance students' interest and facilitate learning. The chief examiners of Examination Development Center (EDC) annual report and comments still showed that students' performance in Basic science examinations have not improved. This necessitates further investigations on the effect of digital technology on students' interest and performance in Basic science. This made the researchers to propose the need for the use of digital technology as an innovative teaching approach leading students to relate concepts to their past experience and discover facts for themselves.

Purpose of the Study

The purpose of this study was to investigate the effects of digital technology as innovational approach in enhancing students' academic

achievements and interest in basic science among secondary school students. Specifically, the study determined:

i. The effect of digital technology on students' achievement in Basic Science and Technology (BST).
ii. The effects of digital technology on students' interest Basic Science and Technology (BST).

Research Questions

The study was guided by the following research questions:

1. What is the effect of students' achievement on Basic Science and Technology (BST)?
2. What is the effect of digital technology on students' achievement in Basic science and Technology (BST)?

Hypotheses

The following hypotheses were tested at 0.05 level of significant

$H0_1$ There is no significant difference in the mean achievement scores of JSS 2 students taught Basic science using digital technology and those taught using conventional method.

$H0_2$ There is no significant difference in mean interest scores of JSS 2 students taught Basic science using digital technology and those taught using conventional method.

Methodology

A quasi- experimental design was used for the study. According to Ary, Jacobs and Sorensen (2010), this design is often used in classroom experiments when experimental and control groups are naturally assembled as intact classes. The study was carried out in Udi education zone, one of six education zones in Enugu State, Nigeria. The choice of the zone was based on the fact that the zone was most populated with secondary schools. The populous secondary schools in the zone also gave sufficient sampling size for more reliable result. Another advantage was the proximity of the area to the researcher which resulted in better supervision of research assistants. The population of the study was six thousand, two hundred and eleven (6,211) JSS 2 students in the fifty four (54) public secondary schools in Udi education zone. The Zone is made up two local government areas viz. Ezeagu and Udi Local Government Areas consisting of 32 and 25 public secondary schools respectively. 121 students comprised of 59 experimental students and 62 control group students participated in the study. The students were sampled using purposive selected from the fifty four public secondary schools in the

zone. The researchers selected two public schools from the two LGA that made up the education zone. The two selected intact classes were each randomly assigned to experimental and control groups (ie. GroupA - experimental group and Group B - control group). The experimental group was taught with digital technology while control group was taught with conventional method.

The instruments used for data collection were Basic Science and Technology Concept Test (BSTCT) and Basic Science and Technology Interest Scale (BSTIS). The BSTCT consisted of 20 multiple test items and was developed by the researcher. The initial draft of the BSTCT Instrument consisted of 35 items. These were modified as a result of face validity and trial testing. Final draft of 20 items was then considered out of the initial poll. The objective of each sub-topic (or section) guided the researcher on the depth the BSTCT items should cover. The test blueprint used in constructing the instrument was developed by the researcher based on the relative emphasis in each of the sub-topic in the JSS 2 Basic scienceand technology curriculum. The BSTCT items were used to assess students' cognitive achievement in the Basic science topics both in pre-testing and post-testing using the same students. The Basic science and technology concept test (BSTCT) was subjected to face and content validation and the Basic science interest scale (BSTIS) was only face validated by two experts in measurement and evaluation and two experts in mathematics Enugu State University of Science and Technology. The test blue print and the lesson plans were also face validated. The scores obtained from the trial testing were used to determine the internal consistency of the instrument. Kuden Richardson formula 20 (KR 20) was used to estimate this. Using the K-R20 formula the reliability coefficient (r) was obtained to be 0.75. The Cronbach Alpha was used to find the reliability of the Basic science and technology interest scale. The reliability was obtained to be 0.85 which shows that the instruments were reliable. The result of the BSTCT items were obtained from the pretest and post-test were scored out of 20 points. That is each option correctly (or rightly) obtained by the subject carries one point, while those obtained wrongly carries no point (zero point). The options of the BSTIS are done using four points Likert Scale; Strongly Agree (SA= 4), Agree (A= 3), Disagree (D=2), Strongly Disagree (SD=1) for a positive item and revised is the case for a negative item. Data collected for the study were analyzed using mean to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance.

Results

The results of this study are presented according to the following the research questions raised;

Research Question 1

What is the effect of students' achievement on Basic Science and Technology (BST)?

Table 1:Mean and Standard Deviation of Pre-Test and Post-Test Scores of Experimental and Control groups of students' achievement on Basic Science and Technology (BST)

	Control and Experimental groups	Mean	Std. Deviation	N
BSCT Pretest	Control group	1.6774	1.30289	62
	Experimental group	2.8983	1.37333	59
	Total	2.2727	1.46629	121
BSCT Posttest	Control group	4.9677	1.70792	62
	Experimental group	11.6271	2.52504	59
	Total	8.2149	3.96696	121

Table 1 above shows that the mean scores of pretest (BSCT) for the experimental group was 2.90 with standard deviation of 1.37, while the control group pretest mean was 1.68 with standard deviation of 1.30. This means that at the beginning of the study, the subjects have almost the same geometric knowledge level. After the treatments were given, the experimental group mean was 11.63 with standard deviation of 2.53 while the control group mean was 4.97 with standard deviation of 1.71. The result therefore, implies that the effective use of digital technology is enhances students' achievement on Basic Science and Technology with an overall mean score and standard deviation of 8.2 and 3.96 respectively.

Hypothesis 1

There is no significant difference in the mean achievement scores of JSS 2 students taught Basic science using digital technology and those taught using conventional method.

The hypothesis was therefore tested using one way analysis of covariance (ANCOVA). The results are given in the table below:

Table 2: **Analysis of Covariance (ANCOVA) for Test of significance Between the Mean BSTCT scores of Experimental and Control Groups of JSS 2 Students Taught Basic Science Using Digital Technology and those Taught using Conventional Method**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Corrected Model	1342.978(b)	2	671.489	145.271	.000	.711	290.542	1.000
Intercept	1977.426	1	1977.426	427.799	.000	.784	427.799	1.000
BSCT Pretest	2.297	1	2.297	.497	.482	.004	.497	.108
Group	1064.780	1	1064.780	230.356	.000	.661	230.356	1.000
Error	545.435	118	4.622					
Total	10054.000	121						
Corrected Total	1888.413	120						

Tests of Between-Subjects Effects

Dependent Variable: BSCT Posttest
a Computed using alpha = .05
b R Squared = .711 (Adjusted R Squared = .706)

Research question 2

Table 3: Mean and Standard deviation of BSISS on the effect of digital technology on students interest scores of JSS 2 students taught Basic science with digital technology and students taught with conventional method

	Control and Experimental groups	Mean	Std. Deviation	N
BSIS Pretest	Control group	29.6290	5.53153	62
	Experimental group	28.2373	6.17095	59
	Total	28.9504	5.86920	121
BSIS Posttest	Control group	48.7742	9.68253	62
	Experimental group	61.8814	7.69927	59
	Total	55.1653	10.93568	121

Table 3 above, reveals that the pretest mean scores in the experimental group was 28.24 with standard deviation of 6.17 while in the control group the mean pretest BSIS scores was 29.63 with standard deviations of 5.53. This results show that the mean achievement scores of experimental group is higher than that of the control group. The null hypothesis is therefore, rejected at

0.05 level of significance. This means that at the beginning of the study, the subjects were almost at the same level in their interest in geometry before the commencement of the study. After the treatments were given, the experimental group means was 61.88 with standard deviation of 7.70 while the control group mean was 48.77 with standard deviation of 9.68. To further ascertain whether the noted difference in the students' interest is statistically significant, hypothesis two was tested:

Hypothesis 2

There is no significant difference in mean interest scores of JSS 2 students taught Basic science and Technology using digital technology and those taught using conventional method.

Table 4: Analysis of Covariance (ANCOVA) for Test of significance Between the Mean BSTIS scores of Experimental and Control Groups of JSS 2 Students Taught Basic Science Using Digital Technology and those Taught using Conventional Method Covariance (ANCOVA) for BSTIS scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power (a)
Corrected Model	5212.172(b)	2	2606.086	33.651	.000	.363	67.302	1.000
Intercept	13333.779	1	13333.779	172.171	.000	.593	172.171	1.000
GISPretest	18.486	1	18.486	.239	.626	.002	.239	.077
Group	5193.609	1	5193.609	67.062	.000	.362	67.062	1.000
Error	9138.522	118	77.445					
Total	382579.000	121						
Corrected Total	14350.694	120						

Dependent Variable: BSIS Post

a. Computed using alpha = .05

b. R Squared = .363 (Adjusted R Squared = .352)

The data presented in Table 4 above reveals that the reading across *Group* row and sig. column the value is .000 less than .05. This implies that the noted difference between the interest scores of the experimental and control groups is significant (p=.000<.05) in favour of the experimental group.

Discussion of findings

From the tables presented, the results revealed that teaching method is a significant factor in students' achievement in Basic science. This may imply that students achievement in Basic science is related to the way and manner (method) the concept are presented. From table 3, the evidence obtained revealed that digital technology as innovational teaching approach post-test (experimental) produced a higher mean (11.63) achievement score greater than the conventional method post-test with lower mean (4.97). Therefore, the digital technology as innovational teaching approach is more effective in enhancing students' concepts in Basic science than the conventional method. This result is in line with Ekete (2015) who concluded that students using guided discovery, inquiry method concept mapping method performed better than those taught using expository or conventional methods.

The success of the experimental group over the control group could be due to the fact that the experimental group was provided with variety of digital technological materials, appropriate reasoning, and step-by-step transfer of knowledge to the problem at hand that facilitated understanding and retention of what has been learned. Hence the significant difference between the performance of experimental group and the control group. Regarding students' interest, table 5, revealed that students taught Basic science concepts with digital technology as innovational teaching approach had enhanced interest score of (61.95) more than those taught with conventional method (47.06). The reason may have been that the students were curious and anxious to transfer knowledge from what they know to the problem at hand with the technological advances in science. These made them to understand faster as they form mental pictures of the concepts correctly. Their high interest must have contributed immensely to the high achievement. This agreed with Onyeabor (2016) who concludes that students who are properly handled and taught well using innovational approaches are bound to develop a high interest for that subject and the teacher who taught it than those who are poorly managed. Also, Lytras et al. (2018) affirms that present day students are more used to absorbing information from the screen than from the printed page, and they find teachers who use technology to be more reliable and knowledgeable than those teachers that do not use digital technology during teaching and learning.

Conclusion

The study investigated the effect of digital technology as innovational approach in enhancing students' academic achievements and interest in basic science among secondary school students. The importance of technology

(ICT) cannot be overemphasized. From the finding and discussion of the study, the following conclusions are made: Digital technology as innovational teaching approach was significantly better than the conventional method in enhancing students' achievement in Basic science. Digital technology as innovational teaching approach enhanced students' achievements and interest more than the conventional method.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Regular orientation should be given to students on the effective use of ICT to enhance learning.
2. Workshops, seminars should be organized for teachers and students until everyone has mastered the basic technological advances in science.
3. Primary, secondary, technical and teacher training institutions should include the use of ICT in the teaching of Basic science.
4. Government should recruit qualified Basic science teachers who are computer literate.

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